Cornell University
College of Agriculture and Life Sciences

USDA United States Department Of Agriculture
Agricultural Research Service

Integrated Management of Arthropod Pests and Root Rot Diseases of Greenhouse Floriculture

John Sanderson, Entomology, Cornell University, Ithaca, NY, jps3@cornell.edu; Margery Daughtrey, Plant Pathology, Cornell University, LIHREC, Riverhead, NY, mld9@cornell.edu; and Stephen P. Wraight, USDA-ARS, Ithaca, NY, spw4@ars.usda.gov

USDA Research Scientist Louela Castrillo

Cornell Entomology Graduate Students and Postdoctoral Scientists: Sarah Braun, Melanie Filotas, Doo Hyung Lee, Sarah Jandricic, Todd Ugine

This poster very briefly encapsulates most, but not all, of the research we have accomplished during the last 5 years. Please contact the authors for further information about any of these, or our additional, accomplishments.

Project Objectives:

∞ Development of multi-component biologically-based IPM programs for key floriculture pests, including thrips, whiteflies, aphids, and shore flies. Programs are based on biological and biorational control agents and cultural practices (such as trap cropping).

∞ Development of integrated management techniques for *Pythium* and other soil-borne pathogens, causative agents of root rot and damping-off diseases. Techniques are based on biological, biorational and reduced-risk pesticides and cultural practices (primarily sanitation). (Research on this Objective is primarily reported on the poster by M. Daughtrey et al.)

∞ Elucidation of the role of fungus gnats in the establishment and spread of root rot diseases.

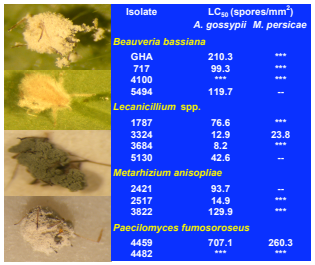
Aphids

Conducted a survey of aphid pests in 41 northeastern commercial greenhouses. Found that green peach and foxglove aphids were the 1st and 2nd most dominant species, respectively. Melon aphid, previously the 2nd most common pest, was found in only 6% of greenhouses. Van Driesche et al. 2008. Fla. Entomol. 91(4): 583-591.

Spring Greenhouse Survey of Aphids in NY & MA

Aphid Species	Percent of Samples
Green peach aphid	53%
Foxglove aphid	28%
Melon aphid	6%
Aphis sp.	4%
Potato aphid	4%

Completed studies describing the biology and pest potential of foxglove aphid. Populations were found to increase fastest at 77ºF, but the aphid also did well at much cooler temperatures (≤ 50ºF), indicating a need to scout this pest in spring crops. High mortality occurred at 95ºF, suggesting temperature manipulation could be a useful tactic for foxglove aphid control.

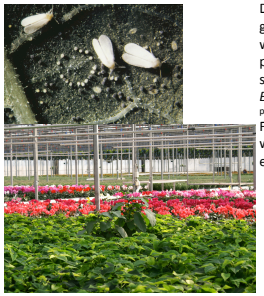


Isolate	LC_{50} (spores/mm^2) *A. gossypii*	*M. persicae*
Beauveria bassiana		
GHA	210.3	***
717	99.3	***
4100	***	***
5494	119.7	--
***Lecanicillium* spp.**		
1787	76.6	***
3324	12.9	23.8
3684	8.2	***
5130	42.6	--
Metarhizium anisopliae		
2421	93.7	--
2517	14.9	***
3822	129.9	***
Paecilomyces fumosoroseus		
4459	707.1	260.3
4482	***	***

LC50's for isolates of four fungal species against melon aphid and green peach aphid

Determined that virulence of the recently registered fungal pathogen *Metarhizium anisopliae* against aphids was enhanced by exposure of the dry spores to high humidity for 48 hours prior to use. Pre-humidification was found to protect spores from injury that can occur when they are rapidly mixed in water and to "jump start" the germination/infection process.

Trap plants for whiteflies



Determined that eggplant is highly attractive to greenhouse whitefly (*Trialeurodes vaporariorum*) with potential for use as a trap plant against this pest, whereas neither eggplant nor cucumber are sufficiently attractive to be useful in managing *Bemisia* whiteflies. D-H Lee et al. Entomol. Exper. Applic. (in press)

Found that selection of a host plant by *Bemisia* whiteflies is affected by presence of natural enemies.

Hunter flies

Female hunter fly eating a fungus gnat

Larval hunter fly (left) attacking a fungus gnat larva

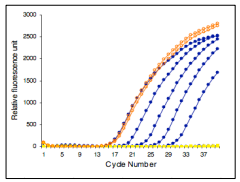
Described the nutritional biology and predatory feeding habits of larval hunter flies reared on fungus gnat and shore fly larvae.
Determined that hunter fly larvae consumed large numbers of prey of all ages (instars) and fed actively for 12–14 days.

Shore flies

*Characterized pathogenicity of new strains of the insect pathogenic fungus *Beauveria bassiana* collected from shore flies. Determined that the new strains were 40–130 times more virulent against shore flies than those used in currently available biopesticides. L. Castrillo et al. 2008. Biol. Control 45(1): 154-162.

*Published life tables and developmental times for shore flies at 3 constant temperatures. T. Ugine et al. 2007. Environ. Entomol. 36:989-997

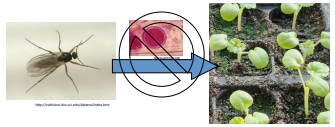
Molecular Assay for *Pythium aphanidermatum*



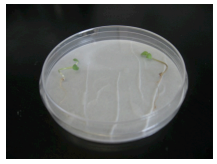
Developed a molecular assay (real-time PCR and probe) for species-specific detection and quantification of *Pythium aphanidermatum*.

Used the assay to show that *P. aphanidermatum* ingested by fungus gnat larvae does not pass to the adult stage (adult fungus gnats do not harbor *Pythium* internally).

Fungus gnats and *Pythium aphanidermatum*



Determined that fungus gnats are unlikely crop-to-crop or greenhouse-to-greenhouse vectors of *P. aphanidermatum* root rot pathogens. Conducted studies showing that adult fungus gnats do not pick up and transmit infectious *Pythium* propagules from diseased to healthy plants.



"Choice" assay to measure fungus gnat preference for uninfected (left) vs. infected geranium seedlings

Determined in laboratory tests that rather than predisposing geranium seedlings to *Pythium* infection, feeding by fungus gnat larvae induced resistance to this pathogen, significantly reducing seedling mortality. Results suggest that low-level damage by fungus gnats may actually benefit host plants by stimulating defenses that hinder disease-causing microbes. S.E. Braun et al. Phytopathology (in press)

Demonstrated that ovipositing female fungus gnats are highly attracted to plants infected/infested with a broad range of microbes, including *Pythium*, *Thielaviopsis*, *Trichoderma*, *Beauveria*, and *Xanthomonas*. These findings underscore the importance of greenhouse sanitation in pest control and have important implications with respect to IPM for other pests.

Thrips

Investigated marigolds as banker plants for the thrips predator *Orius insidiosus*. Found that marigold pollen is a poor food source for *O. insidiosus*, negatively affecting longevity and reproduction. Tests of 12 varieties of marigolds showed that none was a suitable banker plant for this beneficial insect. L. Burgi. 2007. M.S. thesis